

SECTION 12

CLIMATE

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REV.		DATE
NUMBER	REVISION DESCRIPTION	APPROVED

SECTION 12 CLIMATE

12.1 Climatological Factors

Navajo Transitional Energy Company's (NTEC) No Name permit area is located in San Juan County; an arid and semiarid climatic region of northwest New Mexico. The permit area ranges in elevation from 5,300 to 5,600 ft and is characterized by low relative humidity, a high percentage of sunshine, and relatively large annual and diurnal temperature ranges. The permit area and immediate surrounding areas generally have limited relief, are sparsely vegetated, punctuated by ridges and buttes (e.g., Hogback Mountain and Shiprock Peak), and traversed by incised channels (e.g., Chaco River and Pinabete Arroyo). Surrounding areas of higher elevation include the Chuska and Carrizo Mountains in northeast Arizona and northwest New Mexico, Ute Mesa in Colorado and New Mexico, and San Juan Mountains in southwest Colorado and north-central New Mexico.

The area receives precipitation during the summer months, when afternoon showers form as a result of moist air from the Gulf of Mexico moving over the region, and in the fall and winter, when cold fronts moving to the east and southeast from the Pacific Ocean create steady, but usually light, rain and snow showers. The total amount of precipitation received at specific locations may be related to topographic features and changes in altitude. Most snowfall is light and melts within a few days. Vegetation is sparse and surface water is generally absent.

Due to its moderately high elevation (ranging from 5,000 to 6,600 ft above mean sea level [MSL]), San Juan County experiences mild summer and cold winter temperatures. Average annual temperatures near the permit area are in the low to mid-50s. Summer temperatures generally range from the mid-60s to low 90s. Temperatures in excess of 100°F are infrequent. In winter, early morning temperatures normally drop to the high teens or low 20s; however, the air usually warms rapidly and reaches the upper 30s or low 40s by midafternoon.

NTEC Navajo Mine, which is immediately adjacent to the northern boundary of No Name Permit, has collected data from two separate locations, Met Stations I and II, for over 20 years (Exhibit 12.1-1). In 1991, meteorological sensors and data acquisition systems were installed at Met Stations I and II. Each station produces hourly averages of wind speed, wind direction, sigma theta (standard deviation of horizontal wind direction), temperature, relative humidity, and hourly precipitation totals. In addition, NTEC Navajo Mine installed Met Station III in Area 4 North of the NTEC mining lease in April 2006. Met Station III has collected meteorological data for the year 2007 (Table 12.1-1 and Table 12.1-2). These data are consistent with the data collected from the Met I and II stations over the past 20 years. NTEC may install a fourth station in Area 5 as mining progresses.

Data from the Navajo Mine meteorological stations are used to characterize the climate of the No Name Permit as these locations are from a close proximity, equivalent climate, and reliable data source.

12.1.1 Precipitation

Based on the data collected by NTEC from Met Stations 1 and 2 (1991-2024), the average annual precipitation is 5.78 in and the annual average net evaporation rate, based on the Class A Pan method (Williams 1986) is 55 in. The average relative humidity ranges from 22% in June to 61% in January, with an annual average of 41%.

Most precipitation occurs during the monsoon period, which generally occurs in July and August of each year (National Oceanic and Atmospheric Administration 2002). The monsoon periods occur when the prevailing winds shift to the southwest and carry subtropical moisture into the area. Monsoons are characterized by short, sudden cloudbursts, and are often associated with thunderstorms.

Table 12.1-1 depicts the monthly precipitation summary from the Navajo Mine Met Station 3, with an annual average of 6.22 in. for the years 2007-2024. Table 12.1-3 depicts the Navajo Mine regional precipitation summary for Met Stations 1 and 2 from 1991 through 2024.

12.1.2 Temperature

Met Station 3 temperature data for the 17 year span between 2007 and 2024 shows a minimum hourly mean temperature of 19°F and a maximum hourly mean temperature of 86°F. The average annual temperature during this period is 56°F (Table 12.1-2).

12.1.3 Wind

Wind patterns in the vicinity of the permit area are primarily influenced by seasonal and diurnal patterns and by local topography. Along the San Juan River basin during the cooler months, the atmosphere tends to be more stable (more frequent temperature inversions), with longer periods of localized night-time and early morning drainage flows from the mountainous areas north and west of the site. The atmosphere in the vicinity of the permit area tends to be less stable (fewer temperature inversions), characterized by more synoptic southwest-to-northeast flows during warmer months. The area is known for moderate to strong, steady winds. The prevailing wind directions at the NTEC mining lease are out of the northwest and southeast.

Wind speed and direction data are available from Navajo Mine Met Station 1 and Met Station 2. Cumulative wind roses for Met Stations 1 and 2 stations are shown in Figure 12.1-1 and Figure 12.1-2, respectively, for the years 2004 through 2024. The wind rose data show hourly average wind speed in meters per second (m/s) and wind direction. The wind rose profiles at the Navajo Mine show the prevailing high and low velocity wind directions. Episodic wind events can reach velocities up to 51 m/s (114 mph). Generally, the

highest winds occur in the spring and during summer thunderstorm events. These high velocity winds are responsible for, and can be correlated with, the collection of elevated fugitive dust emission data.

(Met 1 and Met 2): Approximately 45% of the wind speed data collected falls between 1.1 to 3.0 m/s (2.5 to 6.7 mph) and comes from the prevailing wind directions SE, SSE, SW, and ESE. Approximately 31% of the collected wind speed data falls within 3.1 to 5.0 m/s (6.7 to 11.2 mph) and comes primarily from the SE and E directions.

(All Met Towers): Approximately 46% of the wind speed data collected falls between 1.1 to 3.0 m/s (2.5 to 6.7 mph) and comes from the prevailing wind directions SSE, S, SE, and SW. Approximately 28% of the collected wind speed data falls within 3.1 to 5.0 m/s (6.7 to 11.2 mph) and comes primarily from the NW and SE directions.

The wind direction patterns are nearly comparable between Met 1 and Met 2. At Met Station 1 the predominant directions are E and NW (Figure 12.1-1). At Met Station 2 the predominant directions are SE and SSE (Figure 12.1-2). The wind rose diagram for Met Station 3 for the years 2007 through 2024 is shown in Figure 12.1-3. The predominant wind directions at this location in Area 4 North are NW and SSE

12.2 Climate Information Collection and Analysis

The meteorological equipment is operated in compliance with Ambient Air Monitoring Guidelines for Prevention of Significant Deterioration (PSD) (U.S. Environmental Protection Agency 1987) and the Meteorological Monitoring Program Guidance for Regulatory Modeling Applications (U.S. Environmental Protection Agency 2000). A companion reference to the PSD document is the U.S. Environmental Protection Agency Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV: Meteorological Measurements (U.S. Environmental Protection Agency 2008). The locations of the meteorological monitoring stations used to collect the data as described in this section of the permit are shown in Exhibit 12.1-1. The data were collected and analyzed by Class One Technical Services, who were also responsible for equipment maintenance and calibration.

References

- National Oceanic and Atmospheric Administration. 2002. Special Feature: The North American Monsoon System. Available at: <http://www.srh.noaa.gov/abq/climate/Monthlyreports/July/nams.htm> (Verified March 29, 2012).
- U.S. Environmental Protection Agency. 1987. Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. EPA-450/4-8/00/, May.
- U.S. Environmental Protection Agency. 2000. Meteorological Monitoring Guidance for Regulatory Modeling Applications. Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. EPA-454/R-99-005, February.
- U.S. Environmental Protection Agency. 2000. Meteorological Monitoring Guidance for Regulatory Modeling Applications. Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. EPA-454/R-99-005, February.
- Williams, Jerry, 1986. New Mexico in Maps. University of New Mexico. Albuquerque, New Mexico

Table 12.1-1 Met Station 3 Average Monthly Precipitation Summary (2007- 2024).

Month	Total precipitation (inches)
Jan	0.43
Feb	0.35
Mar	0.54
Apr	0.31
May	0.49
Jun	0.34
Jul	0.78
Aug	0.98
Sep	0.54
Oct	0.65
Nov	0.38
Dec	0.43
Annual	6.22

Table 12.1-2 Met Station 3 Average Monthly Temperature (2007-2024).

Month	Minimum hourly average temperature* (Fahrenheit)	Maximum hourly average temperature* (Fahrenheit)	Average hourly temperature* (Fahrenheit)
Jan	-8.3	63.5	30.5
Feb	-7.2	72.1	36.9
Mar	9.0	79.7	46.3
Apr	18.3	88.3	54.6
May	28.8	95.3	63.4
Jun	39.9	102.7	75.8
Jul	53.4	103.2	79.4
Aug	47.8	99.9	76.5
Sep	32.2	97.5	87.2
Oct	8.8	90.0	55.4
Nov	8.6	76.3	41.6
Dec	-0.9	60.8	32.0
Mean Annual	19.2	85.8	56.6

*Note: Readings at the meteorological station were taken at a height of 2m.

Table 12.1-3 Navajo Mine Regional Precipitation Data Summary for Met Stations 1 and 2.

Navajo Mine Met Station 1 (1991 – 2024).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total	Annual Monthly Maximum	Annual Monthly Minimum
1991	-	-	-	0.10	0.71	0.11	0.28	0.78	1.52	0.47	1.96	1.43	-	-	-
1992	0.14	0.17	0.97	0.04	1.27	0.01	0.88	1.58	0.52	0.39	0.19	0.48	6.64	1.58	0.01
1993	1.79	0.69	0.48	0.12	0.19	-	0.01	2.55	0.55	0.89	-	0.07	-	-	-
1994	0.04	0.38	0.12	0.24	1.27	0.11	0.18	0.59	1.18	0.85	0.47	0.42	5.85	1.27	0.04
1995	0.44	0.28	0.79	1.20	0.45	0.38	0.13	0.76	0.97	0.03	0.18	0.49	6.10	1.20	0.03
1996	0.16	0.31	0.24	0.14	0.14	0.67	0.08	0.36	0.47	1.73	0.32	0.16	4.78	1.73	0.08
1997	0.53	0.10	0.00	2.62	0.71	0.66	1.02	1.61	1.28	0.26	0.54	0.60	9.93	2.62	0.00
1998	0.24	0.53	0.23	0.03	0.01	0.00	0.54	1.37	0.68	1.87	1.00	0.04	6.54	1.87	0.00
1999	0.16	0.00	0.14	1.18	1.43	0.41	1.29	3.34	0.23	0.01	0.13	0.14	8.46	3.34	0.00
2000	0.47	0.10	1.80	0.00	0.00	0.05	0.28	0.08	-	1.14	0.46	0.14	-	-	-
2001	0.39	0.41	1.39	0.36	0.60	0.01	0.32	1.23	0.31	0.30	0.53	0.36	6.21	1.39	0.01
2002	0.01	0.00	0.06	0.32	0.00	0.00	0.09	0.22	2.77	1.33	0.57	0.26	5.63	2.77	0.00
2003	0.18	1.15	0.37	0.01	0.06	0.00	0.01	0.66	0.22	1.12	0.07	0.03	3.88	1.15	0.00
2004	-	-	-	0.06	0.03	0.04	0.37	0.16	1.78	0.56	0.56	0.14	-	-	-
2005	1.00	1.30	0.33	0.86	0.22	0.23	0.21	1.67	0.00	0.72	0.00	0.02	6.56	1.67	0.00
2006	0.12	0.04	0.12	0.28	0.01	0.00	1.26	0.18	0.63	1.35	0.00	0.28	4.27	1.35	0.00
2007	0.38	0.30	0.00	0.06	0.23	0.02	-	1.34	0.54	0.16	0.01	0.20	-	-	-
2008	0.62	0.68	0.02	0.08	0.27	0.03	0.99	1.01	0.08	0.39	0.67	0.61	5.45	1.01	0.02
2009	0.19	0.15	0.13	0.47	1.30	0.47	0.15	0.03	0.08	0.47	0.19	0.12	3.75	1.30	0.03
2010	1.20	0.85	0.71	0.23	0.10	0.03	0.54	1.25	0.70	1.05	0.06	0.47	7.19	1.25	0.03
2011	0.15	0.04	0.24	0.91	0.47	0.00	0.56	0.20	0.42	1.71	0.36	0.18	5.24	1.71	0.00
2012	0.06	0.30	0.06	0.00	0.05	0.11	0.84	0.29	0.43	0.14	0.12	0.48	2.88	0.84	0.00
2013	0.87	0.26	0.22	0.24	0.11	0.05	0.11	0.99	2.84	0.90	0.67	0.17	7.43	2.84	0.05
2014	0.06	0.28	0.97	0.22	0.28	0.26	0.43	1.11	1.42	0.40	0.35	1.13	6.91	1.42	0.06
2015	1.21	1.00	0.19	0.58	1.48	1.67	1.32	1.89	0.43	0.90	0.91	0.76	12.34	1.89	0.19
2016	0.54	0.12	0.00	0.67	1.28	0.08	0.28	2.15	0.76	0.30	1.02	0.29	7.49	2.15	0.00

Table 12.1-3

Table 12.1-3 (Continued)

2017	0.64	0.95	0.00	0.46	0.75	0.00	0.95	0.14	1.51	0.05	0.09	0.00	5.54	1.51	0.00
2018	0.25	0.07	0.13	0.17	0.28	0.54	0.25	0.01	0.08	1.05	0.05	0.76	3.64	1.05	0.01
2019	0.39	0.81	1.22	0.23	2.47	0.04	0.18	0.05	0.25	0.06	0.69	0.91	7.30	2.47	0.04
2020	0.67	0.18	0.42	0.02	0.07	0.22	0.70	0.00	0.34	0.15	0.17	0.13	3.07	0.70	0.00
2021	0.36	0.40	0.73	0.00	0.03	0.33	0.43	0.06	-	0.35	0.29	0.70	-	-	-
2022	0.01	0.18	0.80	0.13	0.00	0.78	0.79	0.43	0.18	0.21	0.32	0.57	4.40	0.80	0.00
2023	0.69	0.38	1.39	0.05	0.20	0.09	0.47	0.54	0.23	0.00	0.23	0.24	4.51	1.39	0.00
2024	0.46	0.31	1.05	0.04	0.00	0.90	0.15	1.91	0.12	1.51	0.48	0.04	6.97	1.91	0.00

Navajo Mine Met Station 1 1991 through 2024 average annual precipitation: 6.03 inches.

Navajo Mine Met Station 1 and 2 average precipitation 1991 – 2024: 5.78 inches.

* Data not available.

- Dataset incomplete.

Table 12.1-3 (Continued)

Navajo Mine Met Station 2 (1991 – 2024).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total	Annual Monthly Maximum	Annual Monthly Minimum
1991	-	-	-	-	1.01	0.27	0.05	1.33	0.12	0.19	0.20	0.29	-	-	-
1992	0.10	0.11	0.87	0.01	0.88	0.02	0.04	2.47	0.57	0.33	0.10	0.27	5.77	2.47	0.01
1993	1.23	0.50	0.33	0.20	0.55	-	0.07	1.13	1.18	0.80	0.45	-	-	-	-
1994	0.01	0.50	0.14	0.27	1.07	0.13	0.60	0.19	1.02	0.69	0.33	0.30	5.25	1.07	0.01
1995	0.19	0.22	0.35	0.61	0.37	0.31	0.20	0.96	0.58	0.01	0.07	0.44	4.31	0.96	0.01
1996	0.06	0.16	0.07	0.05	0.03	1.15	0.42	0.88	0.26	0.93	0.29	0.06	4.36	1.15	0.03
1997	0.53	0.10	0.00	2.62	0.71	0.66	1.02	1.61	1.28	0.26	0.54	0.60	9.93	2.62	0.00
1998	0.24	0.53	0.23	0.03	0.01	0.00	0.54	1.37	0.68	1.87	1.00	0.04	6.54	1.87	0.00
1999	0.16	0.00	0.14	1.18	1.43	0.41	1.29	3.34	0.23	0.01	0.13	0.14	8.46	3.34	0.00
2000	0.47	0.10	1.80	0.00	0.00	0.05	0.28	0.08	-	1.14	0.46	0.14	-	-	-
2001	0.39	0.41	1.39	0.36	0.60	0.01	0.32	1.23	0.31	0.30	0.53	0.36	6.21	1.39	0.01
2002	0.01	0.00	0.06	0.32	0.00	0.00	0.09	0.22	2.77	1.33	0.57	0.26	5.63	2.77	0.00
2003	0.18	1.15	0.37	0.01	0.06	0.00	0.01	0.66	0.22	1.12	0.07	0.03	3.88	1.15	0.00
2004	-	-	-	0.06	0.03	0.04	0.37	0.16	1.78	0.56	0.56	0.14	-	-	-
2005	0.65	1.26	0.22	0.63	0.25	0.08	0.48	1.06	0.40	0.56	0.00	0.01	5.60	1.26	0.00
2006	0.12	0.02	0.12	0.08	0.08	0.07	1.15	0.05	0.30	1.32	0.00	0.39	3.70	1.32	0.00
2007	0.39	0.38	0.38	0.36	1.38	0.01	1.23	1.27	0.30	0.19	0.43	0.12	6.44	1.38	0.01
2008	0.81	0.51	0.06	0.04	0.18	0.15	0.37	0.09	-	0.35	0.45	0.37	-	-	-
2009	0.19	0.10	0.18	0.40	0.44	0.21	0.06	0.07	0.10	0.35	0.16	0.14	2.40	0.44	0.06
2010	0.99	0.45	0.26	0.20	0.08	0.02	0.17	0.64	0.41	1.32	0.03	0.35	4.92	1.32	0.02
2011	0.00	0.09	0.14	0.99	0.11	0.00	0.81	0.30	1.02	1.19	0.25	0.26	5.16	1.19	0.00
2012	0.00	0.14	0.21	0.00	0.08	0.27	1.28	0.15	0.37	0.08	0.04	0.32	2.94	1.28	0.00
2013	0.79	0.10	0.19	0.23	0.22	0.00	0.50	1.13	1.55	0.56	0.90	0.11	6.28	1.55	0.00
2014	0.02	0.17	0.59	0.16	0.29	0.20	0.75	1.72	1.36	0.35	0.31	1.15	7.07	1.72	0.02
2015	1.10	1.07	0.13	0.59	1.51	2.02	0.95	1.11	0.57	1.04	0.67	0.51	11.27	2.02	0.13
2016	0.30	0.06	0.00	0.36	0.99	0.06	0.13	1.84	0.50	0.29	0.75	0.74	6.02	1.84	0.00

Table 12.1-3 (Continued)

2017	0.41	0.62	0.15	1.16	0.81	0.00	0.46	0.43	0.75	0.02	0.04	0.00	4.85	1.16	0.00
2018	0.10	0.03	0.11	0.05	0.05	0.25	1.16	0.03	0.05	0.66	0.00	0.54	3.03	1.16	0.00
2019	-	-	0.09	0.10	1.41	0.27	0.46	0.00	0.25	0.02	0.67	0.53	-	-	-
2020	0.51	0.14	0.46	0.01	0.00	0.06	1.00	0.10	0.18	0.15	0.17	0.05	2.83	1.00	0.00
2021	0.20	0.23	0.59	0.00	0.13	0.17	0.76	0.42	0.41	0.04	0.07	0.14	3.16	0.76	0.00
2022	-	-	-	0.00	0.00	1.61	3.61	0.01	-	-	0.00	0.38	-	-	-
2023	0.46	0.40	0.02	-	0.00	0.12	0.07	1.00	0.05	0.00	0.20	0.51	-	-	-
2024	0.45	0.15	1.32	0.05	0.00	0.49	0.33	2.56	0.19	1.53	0.38	0.00	7.45	2.56	0.00

Navajo Mine Met Station 2 1991 through 2024 average annual precipitation: 5.52 inches.

Navajo Mine Met Station 1 and 2 average precipitation 1991 – 2024: 5.78 inches.

* Data not available.

- Dataset incomplete.

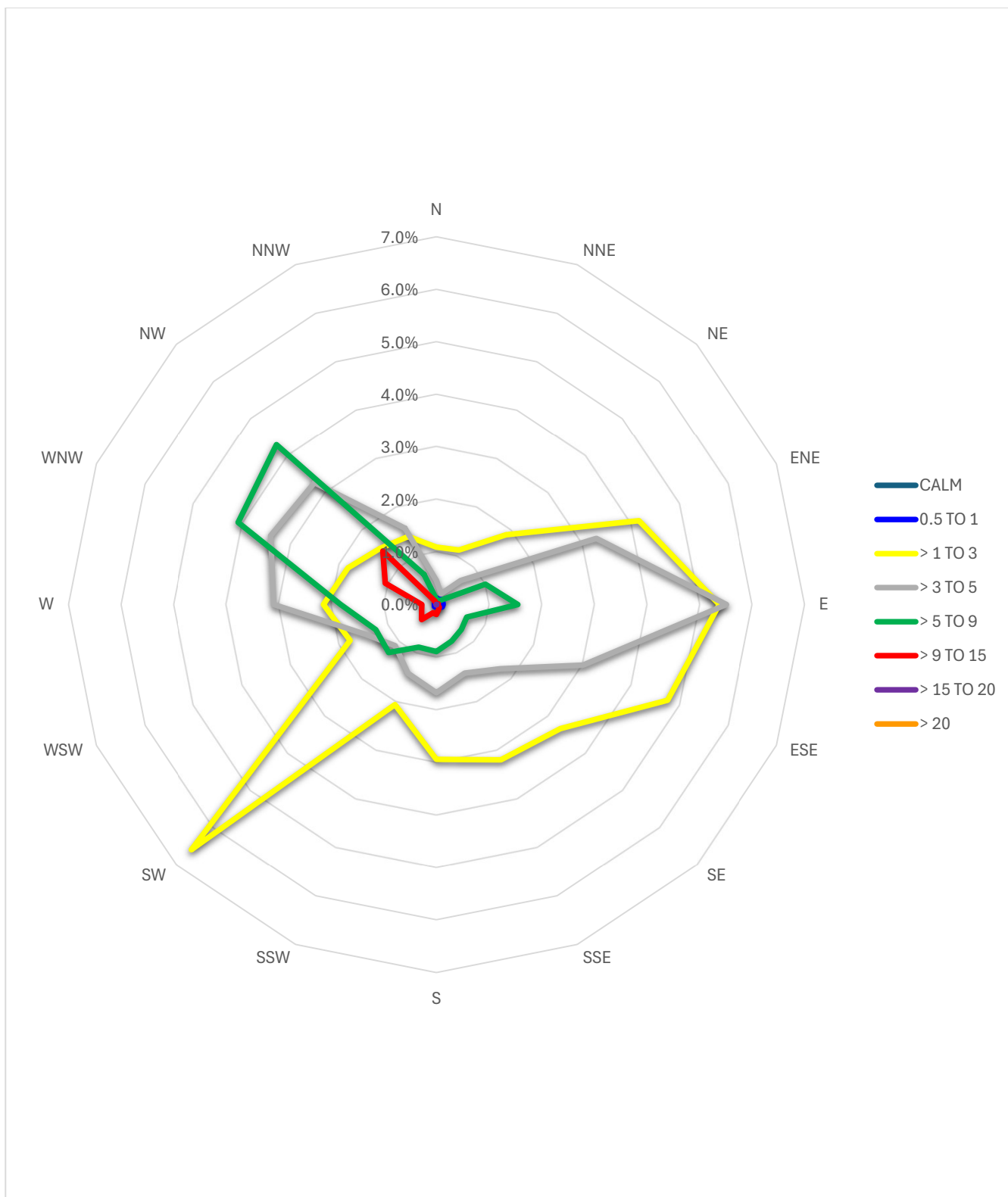


Figure 12-1.1
One-Hour Average Wind Direction vs. One-Hour Average Wind Speed
10-Meter Level
Navajo Mine Met 1
2004-2024

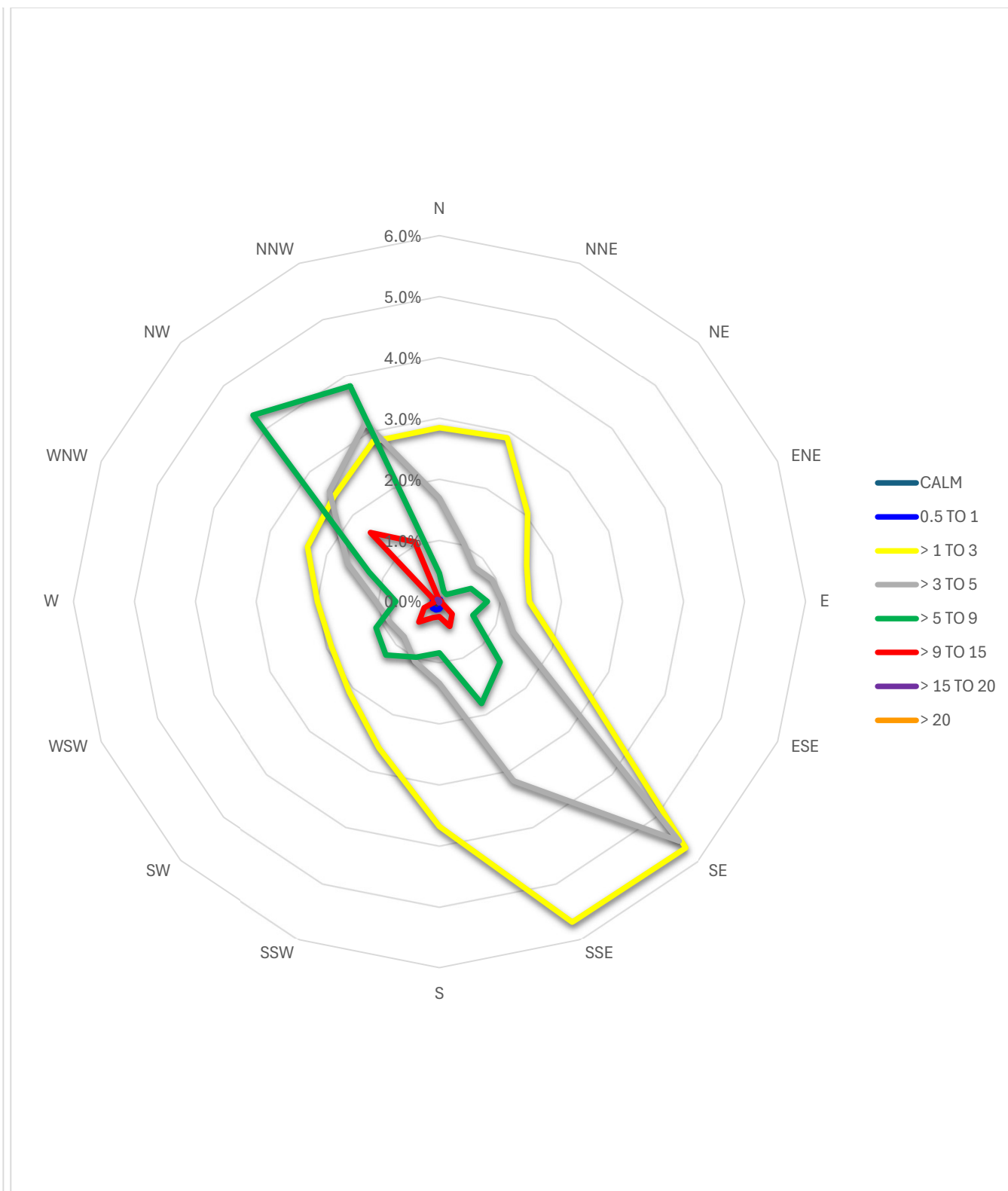


Figure 12-1.2
One-Hour Average Wind Direction vs. One-Hour Average Wind Speed
10-Meter Level
Navajo Mine Met 2
2004-2024

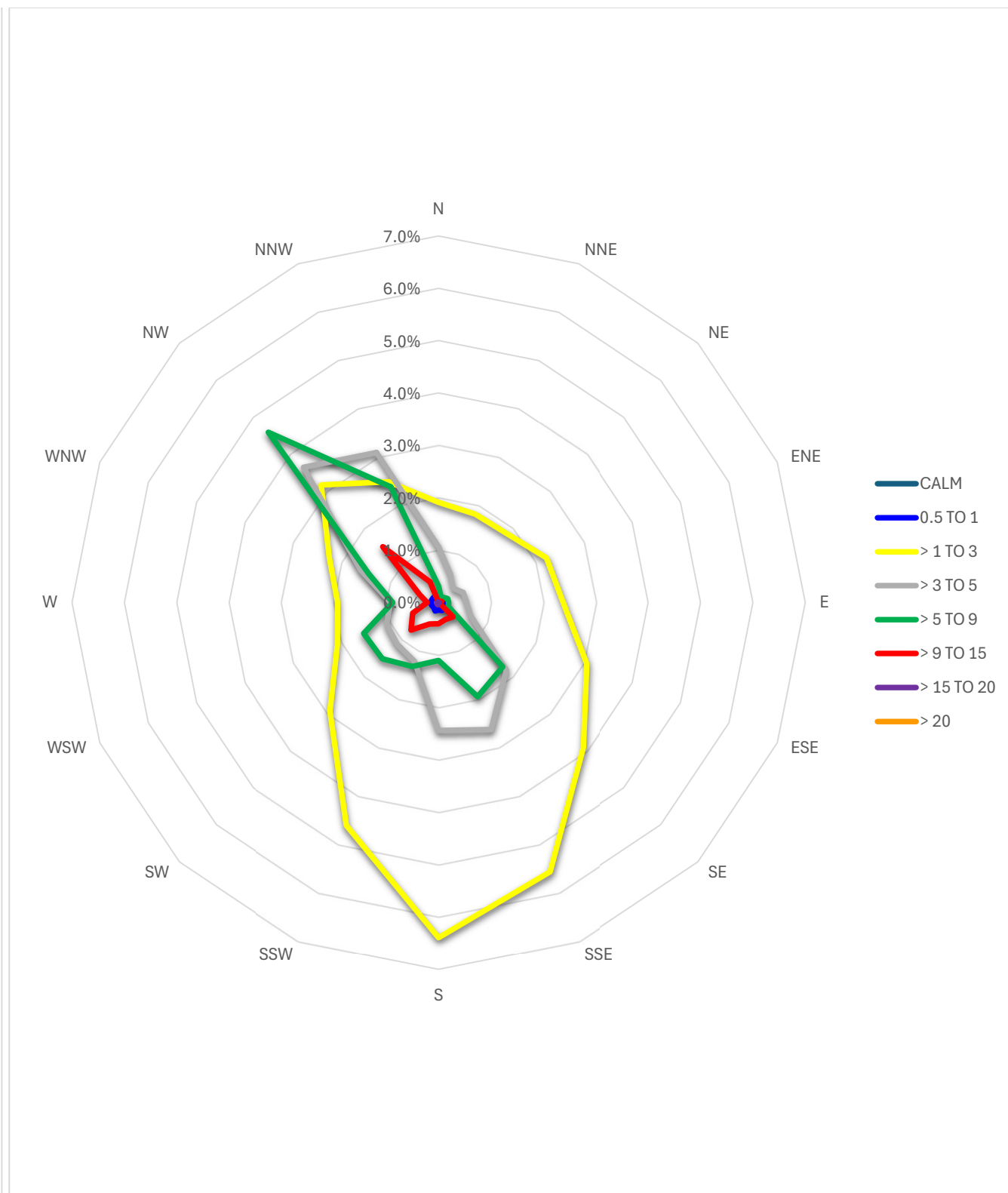
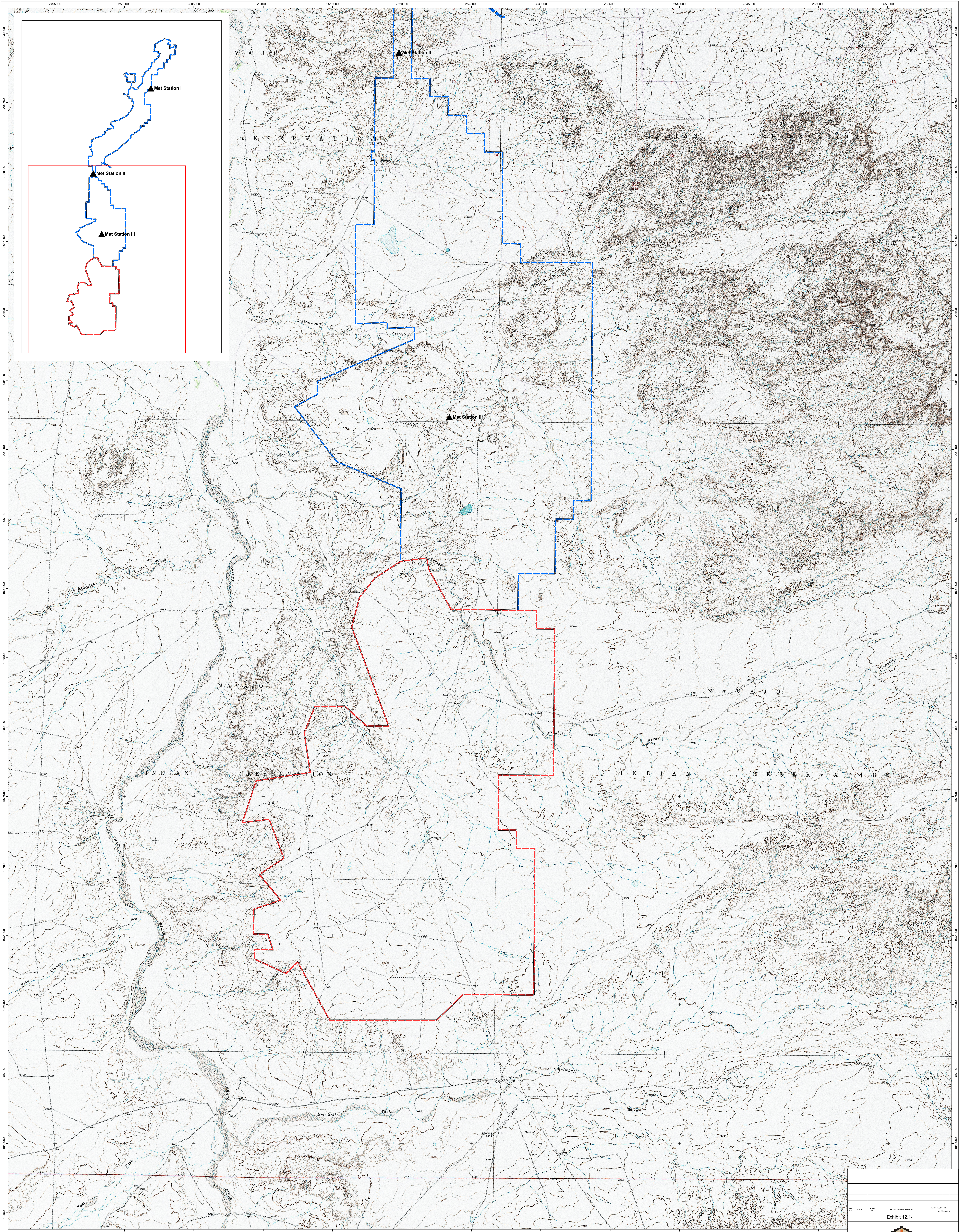


Figure 12-1.3
One-Hour Average Wind Direction vs. One-Hour Average Wind Speed
10-Meter Level
Navajo Mine Met 3
2007-2024



Note:
-USGS Quadrangle Digital Raster Graphics (DRG's) obtained from
New Mexico Resource Geographic Information System Program
(rgis.unm.edu)
Coordinate System:
NAD 1983 StatePlane New Mexico West FIPS 3003 Feet
Datum: North American 1983
Units: US Feet

Legend

- ▲ NTEC Meteorological Station Sites
- Red outline No Name Permit Boundary
- Blue outline NTEC Lease Boundary

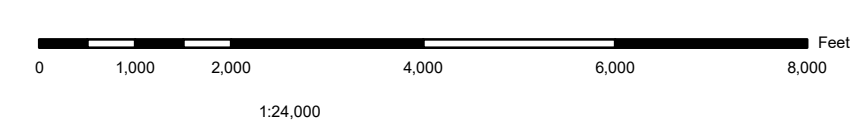


Exhibit 12.1-1			
No Name Permit Area NTEC Meteorological Stations and NNP Area			
PREPARED BY: TH	DRAWN BY: TH	PAPER SIZE: ARCH E	
APPROVED BY: AJ	DATE: 6/12/25		